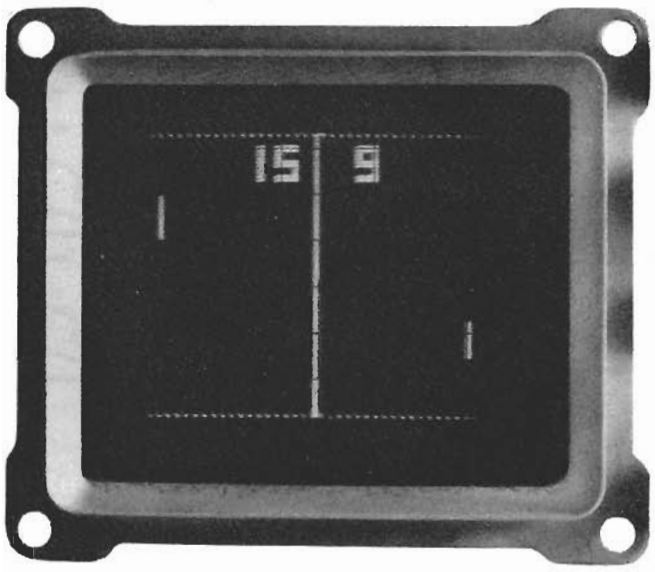
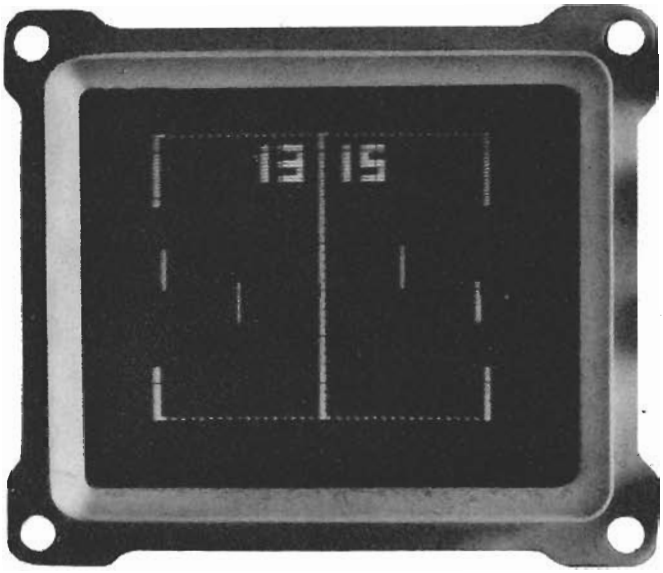
Play Video Games with "SCOPE-ONG"

BY AL PLAVCAN

Now you can play hockey, tennis, and other games on your oscilloscope





THERE IS a way to build a video-game project and avoid problems meeting FCC regulations. Moreover, it frees your TV receiver for normal use. Simply use your *oscilloscope* instead of a TV receiver to display game graphics. This way, you avoid the possibility of TV interference and do not have to pay a premium for an FCC-approved Class I device (r-f modulator and isolation switch). The "Scope-Ong," described here, works just this way.

The circuit uses the readily available General Instruments AY-3-8500-1 game chip, found in many video games on the market. Programmed into this chip are squash, hockey/soccer, and tennis. Automatic on-screen scoring and user-selectable paddle size, ball angle, ball speed, and auto/manual ball serve round out the chip's features. The only requirements for the oscilloscope to be used as the graphics display are that it have provisions for external sync and a Z-axis input.

About the Circuit. Sections A and B of *IC2* in Fig. 1 are used as a crystal-controlled oscillator circuit to drive

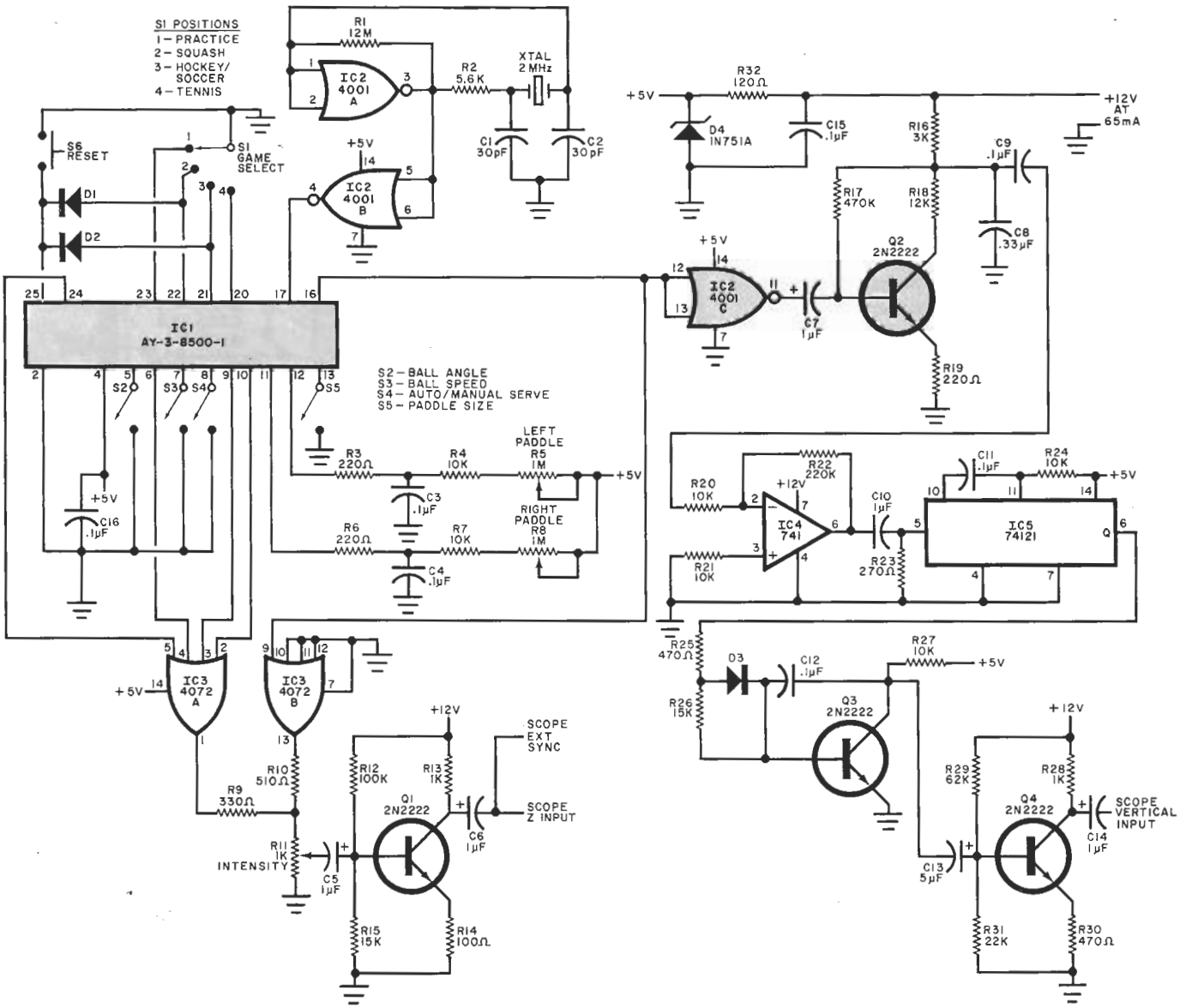


Fig. 1. Adding vertical sweep generator to basic game circuit permits use with conventional oscilloscope.

PARTS LIST

C1,C2—30-pF disc capacitor
C3,C4,C9,C11,C12,C15,C16—0.1-μF, 20-V capacitor
C5,C6,C7,C10,C14—1-μF, 20-V capacitor
C8—0.33-μF, 20-V capacitor
C13—5-μF, 20-V capacitor
D1,D2,D3—1N914
D4—1N751A, 5-V zener
IC1—AY-3-8500-1 game chip (General Instruments) (available from Poly Paks, James Electronics, and other advertisers at the back of this magazine)
IC2—4001 (or 4011) quad 2-input NOR gate
IC3—4072 dual 4-input OR gate
IC4—741 op amp
IC5—74121 monostable multivibrator
Q1 through Q4—2N2222 transistor
The following are ¼-watt, 10% resistors unless otherwise noted:
R1—12 megohms
R2—5600 ohms
R3,R6,R19—220 ohms
R4,R7,R20,R21,R24,R27—10,000 ohms
R5,R8—1-megohm potentiometer
R9—330 ohms
R10—510 ohms
R11—1000-ohm, pc-mount potentiometer
R12—100,000 ohms
R13,R28—1000 ohms
R14—100 ohms
R15,R26—15,000 ohms
R16—3000 ohms
R17—470,000 ohms
R18—12,000 ohms
R22—220,000 ohms
R23—270 ohms
R25,R30—470 ohms
R29—62,000 ohms
R31—22,000 ohms
R32—120-ohm, 1-watt resistor
S1—4-position rotary switch
S2 through S5—Spst switch
S6—Normally open pushbutton switch
XTAL—2.0-MHz crystal
Misc.—Paddle cable; scope interconnecting cable; power supply (12 V, 65 mA); suitable enclosure; dry-transfer lettering kit; machine hardware; hookup wire; etc.

game chip *IC1*. Composite sync pulses generated within *IC1* are available at pin 16; they are buffered by *IC2C* and fed to sync separator *Q2* to extract the vertical-sync pulse.

The vertical pulse is amplified by *IC4* and applied to pulse stretcher *IC5*. The output of *IC5* drives linear ramp generator *Q3*, whose output signal is inverted by *Q4* and used as the vertical input of the scope.

The video outputs from *IC1* available at pins 6, 9, 10, and 24 are combined in *IC3A* to form a composite-video signal, which is then combined with the sync pulse present at the output of *IC3B* to generate the composite sync/video signal across INTENSITY control *R11*. Am-

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continued

plification and inversion of the composite signal occurs in *Q1*, which then feeds the EXT SYNC and Z-axis scope inputs.

Available Z-axis output potential from the project is approximately 10 volts peak-to-peak. To determine if your scope can use this signal, apply at least +5 volts dc to the Z-axis input while a trace is on the screen. If the trace extinguishes or at least changes considerably in intensity, the circuit shown in Fig. 1 can be used.

Construction. The circuit can be assembled on a small printed-circuit board, the etching-and-drilling and components-placement guides for which are shown in Fig. 3. Once the pc-board assembly is wired, it and a 12-volt, 65-mA power supply (Fig. 2) can be mounted inside an appropriate enclosure. Mount the five selector switches, RESET push-

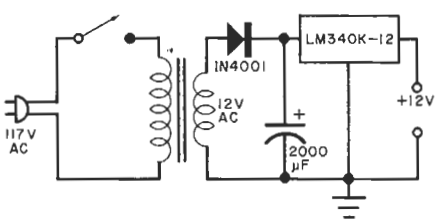


Fig. 2. This simple supply can be built to power the project.

button switch, and game "paddles" *R5* and *R8* on the top of the enclosure.

If desired, the game paddles can be housed in small separate boxes and connected into the circuit via cables and jack/plug assemblies. The jacks for the three scope signals can be mounted on the rear of the box. Finally, if you use a power supply with a power switch, mount the switch wherever convenient on the box. Label the controls, switches, jacks, etc., with dry-transfer lettering.

Checkout and Use. Set your scope's controls as follows: vertical input to 1 volt/cm, horizontal sweep to 5 µs/cm, and sync to EXT. Connect the three leads from the Scope-Ong to the X, Y, and Z inputs of the scope (don't forget

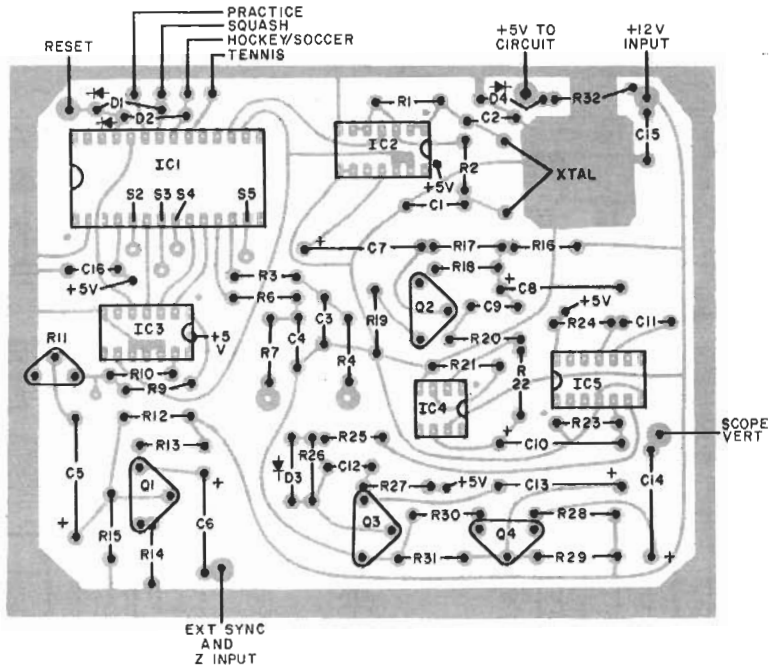
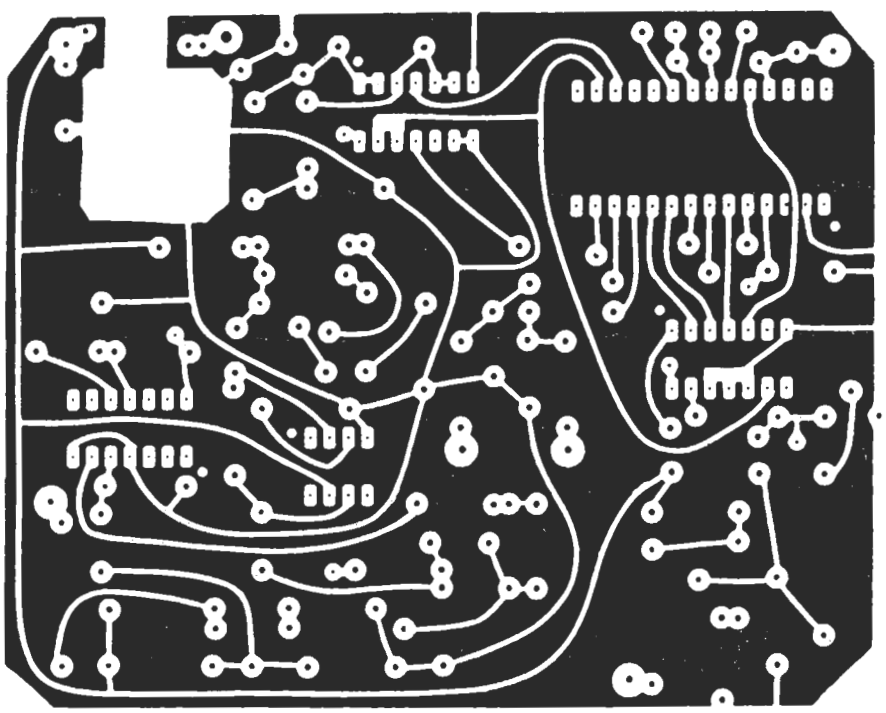


Fig. 3. Actual-size foil pattern for "Scope-Ong" is below. Component installation layout is shown above.



the ground connection). Now, set INTENSITY control *R11* to midrange and turn on both scope and game player.

Select a game via *S1* and note the activity on the scope's screen. Adjust *R11* and the scope's horizontal and sync controls for the best image of the selected game.

Press and release RESET switch *S6*; the score displayed should be 0–0. Closing AUTO/MANUAL SERVE switch *S4* (AUTO position) causes the ball to be served automatically until the end of the game. If desired, *S4* can be opened and then closed each time you wish the ball to be served. Among the project's other options are *S2* that changes ball angle, *S3* that changes ball speed, and *S5* that changes paddle size.

In Closing. The Scope-Ong provides most of the functions and all of the features found in similar video-game devices on the market. The one thing it does not give you is possible trouble with your neighbors over TVI. ◇

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